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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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09/379,753 08/24/99 GRIMBERGEN M 3948/USA/SIL

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PATENT DEPARTMENT  
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IM62/0412

EXAMINER

ZERVIGON, R

ART UNIT

PAPER NUMBER

1763

DATE MAILED:

04/12/00

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

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# Office Action Summary

Application No.

09/379,753

Applicant(s)

GRIMBERGEN, MICHAEL N.

Examiner

Rudy Z rvlgon

Group Art Unit

1763



☒ Responsive to communication(s) filed on Aug 24, 1999

☐ This action is FINAL.

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 1035 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire 3 month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

## Disposition of Claim

☒ Claim(s) 1-56 is/are pending in the applicat

Of the above, claim(s) 15-22 and 52-56 is/are withdrawn from consideration

☒ Claim(s) 23-29 is/are allowed.

☒ Claim(s) 1-4, 11-14, 30, 31, 35-38, and 40-51 is/are rejected.

☒ Claim(s) 5-10, 32-34, and 39 is/are objected to.

☒ Claims 15-22 and 52-56 are subject to restriction or election requirement.

## Application Papers

☒ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The drawing(s) filed on \_\_\_\_\_ is/are objected to by the Examiner.

☐ The proposed drawing correction, filed on \_\_\_\_\_ is ☐ approved ☐ disapproved.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. § 119

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☐ Some\* ☒ None of the CERTIFIED copies of the priority documents have been

☐ received.

☐ received in Application No. (Series Code/Serial Number) \_\_\_\_\_.

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

\*Certified copies not received: \_\_\_\_\_

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

## Attachment(s)

☒ Notice of References Cited, PTO-892

☒ Information Disclosure Statement(s), PTO-1449, Paper No(s). 2

☐ Interview Summary, PTO-413

☒ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

— SEE OFFICE ACTION ON THE FOLLOWING PAGES —

Art Unit: 1763

## DETAILED ACTION

### *Election/Restriction*

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:
  - I. Claims 1-14, 23-29, 30-51 drawn to an apparatus for substrate processing, classified in class 118, subclass 723AN..
  - II. Claims 15-22, 52-56, drawn to a method for monitoring plasma processing, classified in class 118, subclass 723AN.
2. The inventions are distinct, each from the other because of the following reasons: ~~Inventions~~  
I and II are related as process and apparatus for its practice. The inventions are distinct if it can be shown that either: (1) the process as claimed can be practiced by another materially different apparatus or by hand, or (2) the apparatus as claimed can be used to practice another and materially different process. (MPEP § 806.05(e)). In this case the process as claimed can be practiced by another materially different apparatus not requiring the claimed attributes of claims 1-14, 23-29, 30-51 such as instead of a signal analyzer normalizing the spectral response, a neural network training algorithm may be employed as part of the apparatus for processing and conditioning.
3. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art because of their recognized divergent subject matter, restriction for examination purposes as indicated is proper.
4. During a telephone conversation with Ashok K. Janah (415.538.1555) on March 29, 2000 a provisional election was made with traverse to prosecute the invention of Group I, claims 1-14, 23-

Art Unit: 1763

29, 30-51. Affirmation of this election must be made by applicant in replying to this Office action. Claims 15-22, 52-56 of Group II withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

5. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a petition under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(I).

***Claim Rejections - 35 USC § 102***

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

7. Claims 1, 2, 3, 14, 40, 41, 43 are rejected under 35 U.S.C. 102(b) as being anticipated by Sun et al (U.S. Pat. 5,664,066). Sun et al describe a neural network controller for plasma assisted process (column 5, lines 18-61) which is trained with optical emission spectra as produced from a radiation source contained within the plasma reactor. Specifically, Sun et al teach:

Art Unit: 1763

- a. A process chamber (item 102, Figure 1) defining a chamber interior housing a radiation source where one or more work pieces are supported (column 11, lines 1-2) can be inserted for ion treatment
- b. An energy source (item 138, Figure 1; column 10, line 64) for setting up an ion plasma within the process chamber
- c. An optical sensor detector (items 112,114, Figure 1) for monitoring the intensity and wavelength (Figure 2; column 11, lines 1-59; column 13, lines 42-67) the ion plasma and for providing optical analysis data (column 11, lines 1-59) of the radiation sources emanating from the plasma contained within the reactor
- d. A data store (item 118, Figure 1; column 11, lines 65-67; column 12, lines 1-34) for correlating optical analysis data with a parameter of the ion plasma within the process chamber to allow adjustment of that parameter based upon an output from the optical sensor.
- e. The data processing, or signal analyzer, of Sun et al is provided with instructions for normalizing a property, specifically output intensity value  $O_i$  (column 14, lines 1-9), of the first radiation  $I_i$  relative to a property (output intensity) of the second radiation  $A_i$ . Here the Sun et al numerator corresponds to  $X_t$  (line 20, page 14, specification - "variations canceled") and the sun et al denominator corresponds to  $Y_t$  (line 20, page 14, specification). Additionally, Sun et al describe additional normalization techniques (column 14, lines 9-13) as would be anticipated to those skilled.

Art Unit: 1763

Specifically, Sun et al describe a method for monitoring a plasma process (column 10, lines 66-67 through column 11, lines 1-14). Sun et al implicitly describe first endpoint detection (column 4, lines 35-41) via a predetermined result (column 13, lines 30-42; column 14, lines 50-61) drawn from *evaluating a cumulative condition of all parameters effecting* the process plasma (column 3, lines 15-60). Additionally, Sun et al provide for *optical emission* collection and evaluation in the range of the far IR and near UV (column 4, lines 23-24) and the relevance of this spectral range to the plasma processing conditions (column 4, lines 25-28).

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

9. Claims 1, 2, 4, 11, 44, 45, 46, 48, 49, are rejected under 35 U.S.C. 102(b) as being anticipated by BöBel et al (U.S.Pat. 5,564,830). BöBel et al describe plasma method an apparatus for determining the thickness and temperature of coating materials in semiconductor manufacturing (column 1, lines 5-16). Specifically, BöBel et al describe a substrate (item 1, Figure 1; column 6, 1-24) processing apparatus with an inherent chamber consisting of:

- f. A radiation source (item 6, Figure 1; column 6, 1-24)
- g. A detector (items 7,8, Figure 1; column 6, 1-24) to detect a property of a radiation, in this case intensity (column 2, 45-50), and generate a reference signal

Art Unit: 1763

- h. A radiation modulator (items 9, 4.1, 4.2, 8, Figure 1; column 6, 1-24) in a path of the radiation being transmitted from the radiation source to the chamber. The radiation modulator receives a signal from the radiation source and controls a property of the radiation in relation to a reference signal (item 10, Figure 1; column 6, 1-24). The controlled property in this sense being the filtered frequencies (low/high pass).
  - i. The radiation modulator additionally contains an electro-optical transducing means (item 7, Figure 1; column 6, 1-24)
10. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

11. Claims 44, 45, 46, 48, 49, are rejected under 35 U.S.C. 102(b) as being anticipated by Betz et al (U.S. Pat. 4,838,694). Betz et al describe plasma method an apparatus for determining wafer processing conditions in semiconductor manufacturing (column 1, lines 50-68). Specifically, Betz et al describe a substrate (item 1, Figure 3; column 4, 1-29) processing apparatus within a chamber consisting of:

- j. A radiation source (items 100,70, Figure 3; column 4, 1-29)
- k. A detector (items 70, Figure 3; column 4, 40-45) to detect a property of a radiation, in this case intensity (item 90,92, Figure 3; column 4, 61-69), and generate a reference signal

Art Unit: 1763

- l. A radiation modulator (items 30,40,96, Figure 3; column 4, 1-29) in a path of the radiation being transmitted from the radiation source to the chamber. The radiation modulator receives a signal from the radiation source and controls a property of the radiation in relation to a reference signal (item 72, Figure 3; column 4, 1-29). The controlled property in this sense being the filtered frequencies (low/high pass).
- m. The radiation modulator additionally contains an elector-optical transducing means (items 32,72 Figure 3; column 4, 1-45)

***Claim Rejections - 35 USC § 103***

12. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

13. Claim 42 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sun et al (U.S.Pat. 5,664,066). Sun et al describe a plasma processing apparatus as detailed above in the rejection to claims 1, 2, 3, 14, 40, 41, 43. However, Sun et al do not describe an apparatus with capabilities whereby the feedback controller (item 122, Figure 1) is adapted to maintain the property of the radiation, in this case the intensity, at a constant level.

It is the examiner's position that a person of ordinary skill in the art at the time the invention was made would have found it obvious to develop a control strategy whereby the feedback controller



Art Unit: 1763

(item 122, Figure 1) is adapted to maintain the property of the radiation, in this case the intensity, at a constant level. The capabilities of the Sun et al apparatus are with these bounds according to the process variables reported to be controlled. These include flow (item 132, 134; Figure 1), pressure (item 136, Figure 1), and power applied to the plasma (item 138, Figure 1). Motivation for the feedback controller adapted to maintain the property of the radiation, in this case the intensity, at a constant level in the Sun et al apparatus would be, for example, to calibrate the output from the photodiode array providing for a more accurate assessment of peak intensities.

14. Claim 12, 13, 38, 51 are rejected under 35 U.S.C. 103(a) as being unpatentable over BöBel et al (U.S.Pat. 5,564,830). BöBel et al describe plasma method an apparatus for determining the thickness and temperature of coating materials in semiconductor manufacturing as described above in the rejection to claims 44, 45, 46, 48, 49. BöBel et al, however, do not particularly describe transmission of spectral radiation data through fiber transmission means.

It is the examiner's position that a person of ordinary skill in the art at the time the invention was made would have found it obvious to modify the BöBel et al apparatus by implementing the well known optical data processing industrial standard of fiber transmissions in the BöBel et al apparatus. Motivation for transmitting the optical data through fiber communication means is drawn from the very benefits of such transmissions that are well known in the industry and include, but not limited to, the benefit of lessening dispersion that is more prominently present in transmission paths not using fiber.

Art Unit: 1763

15. Claim 12, 13, 30, 31, 35, 36, 37, 38, 51 are rejected under 35 U.S.C. 103(a) as being unpatentable over BöBel et al (U.S.Pat. 5,564,830) in view of van Pham et al (U.S.Pat. 4,776,695). BöBel et al describe plasma method an apparatus for determining the thickness and temperature of coating materials in semiconductor manufacturing as described above in the rejection to claims 44, 45, 46, 48, 49. BöBel et al, however, do not particularly describe transmission of spectral radiation data through fiber transmission means. van Pham et al describe thin film thickness determination (column 1, lines 19-35) means in plasma assisted processing. Specifically, optical data collection via fiber transmission is taught by van Pham et al (column 3, lines 50-55).

It is the examiner's position that a person of ordinary skill in the art at the time the invention was made would have found it obvious to modify the BöBel et al apparatus by implementing the well known optical data processing industrial standard of fiber transmissions in the BöBel et al apparatus as taught by van Pham et al. Motivation for transmitting the optical data through fiber communication means is drawn from the very benefits of such transmissions that are well known in the industry and include, but not limited to, the benefit of lessening dispersion that is more prominently present in transmission paths not using fiber.

Art Unit: 1763

*Allowable Subject Matter*

16. Claims 5-10, 32, 33, 34, 39 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

17. Claims 23-29 allowed.

18. The following is a statement of reasons for the indication of allowable subject matter: Claims 23-39 are found to be allowable over the prior art retrieved. Specifically, Sun et al (U.S.Pat. 5,664,066) which provides the closest teachings of the above rejected claims nowhere provides a motivation for collecting, apart from the plasma emissions, a separate emission signature characteristic of a reflection of radiation from the plasma confines. C.F.F. Karney et al<sup>1</sup> do describe how reflected radiation, originating from plasma excitations, “complicate the spatial localization of plasma emission and are often difficult to diagnose” (Section I). However, a combination of Sun et al and C.F.F. Karney et al do not provide an obvious perspective or motivation for arriving at the allowed or objected claims.

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<sup>1</sup>Rev. Sci. Instrum., 70(1), January, 1999

Art Unit: 1763

***Conclusion***

19. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. U.S.Pat. 4,741,801;

*Sov.J.Plas.Phys.* **18**(3),pp.181-185, March 1992

*Phys.Plas.* **4**(11),pp.4069-4073, November 1997

*Phys.Rev.A.* **46**(6),pp.3442-3453, September 1992

*Rev.Sci.Inst.* **57**(8),pp.1971-1973, August 1986

20. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Rudy Zervigon whose telephone number is (703) 305-1351. The examiner can normally be reached on a Monday through Thursday schedule from 8am through 7pm. The official AF fax phone number for the 1763 art unit is (703) 305-3599. Any Inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Chemical and Materials Engineering art unit receptionist at (703) 308-0661. If the examiner can not be reached and specific inquiry on the merits of the cases's prosecution is desired then contact the examiner's supervisor Marian Knode at (703) 308-4311.



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